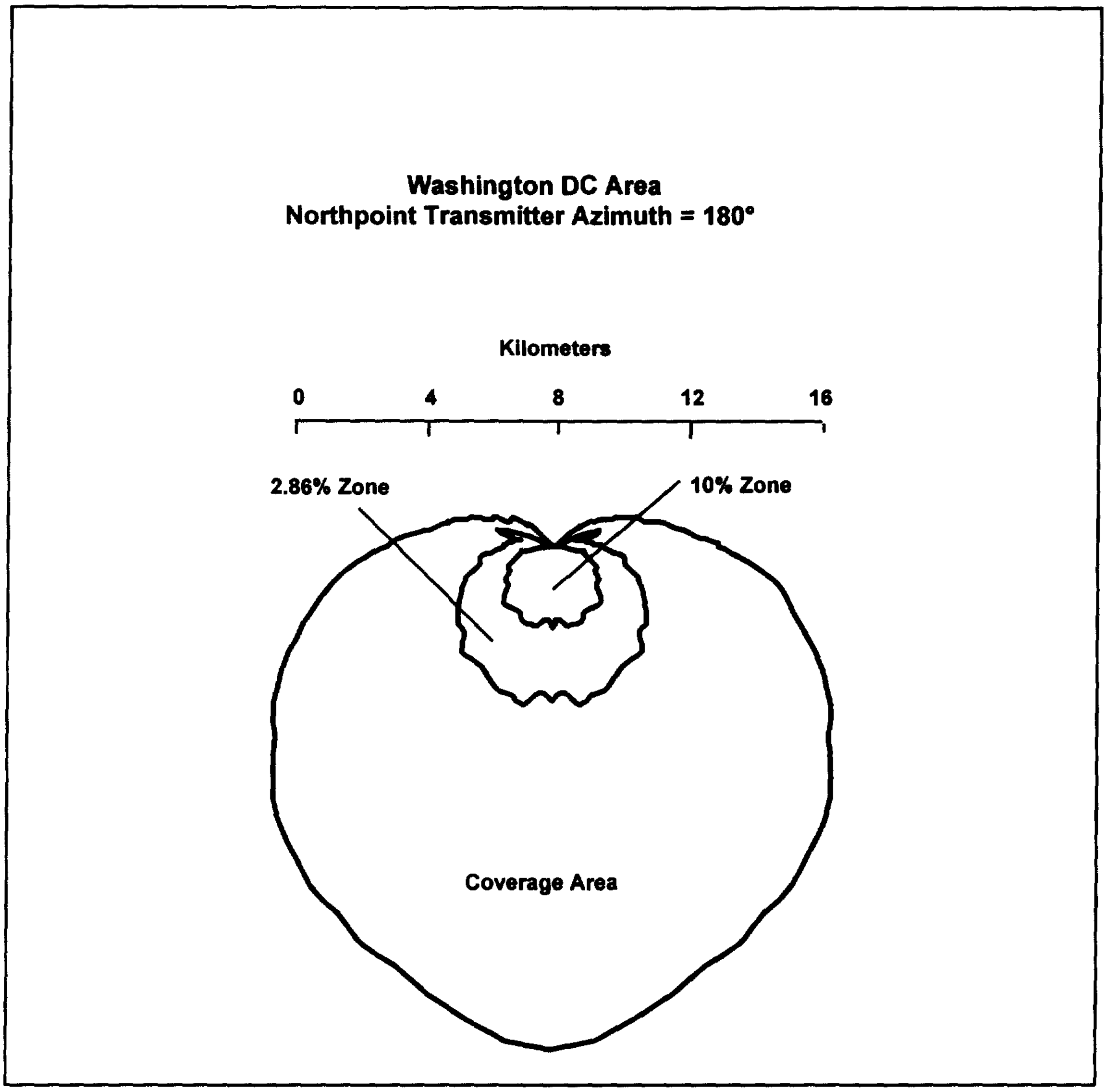

Figure 6.2.3-2:
Interference Zones, Southerly Directed Terrestrial Transmission, Washington, D.C. Area

6.2.4 Generalized Interference Zone Calculation for Washington, D.C. Demonstration

Figure 6.2.4-1 shows the generalized interference zones for the Washington, D.C. demonstration. Note that the size of the zones are very similar to the case of the southerly directed transmission (Figure 6.2.3-2) with the exception that an elongated area extends out to the northeast away from the Northpoint transmitter for each interference zone.

These extended areas of interference would be realized if there were an active DBS satellite operating in the vicinity of 140° W.L. In this situation, the DBS receive antenna is "looking over the top" of the Northpoint transmitter at a relatively low elevation angle. Significant energy from this interference source will be received on the edges of the victim antenna main beam due to the southeasterly pointing direction of the Northpoint transmit antenna.

Operation at 140° W.L. could occur, for example, if an applicant filed for a modified BSS assignment near 140° W.L. for service to the U.S. Other examples of this interference geometry include service from the U.S. assignment at 148° into cities such as Dayton, Ohio, Atlanta Georgia and Tallahassee, Florida, or service from the U.S. assignment at 157° W.L. into Baton Rouge Louisiana, Little Rock, Arkansas or Cedar Rapids, Iowa.

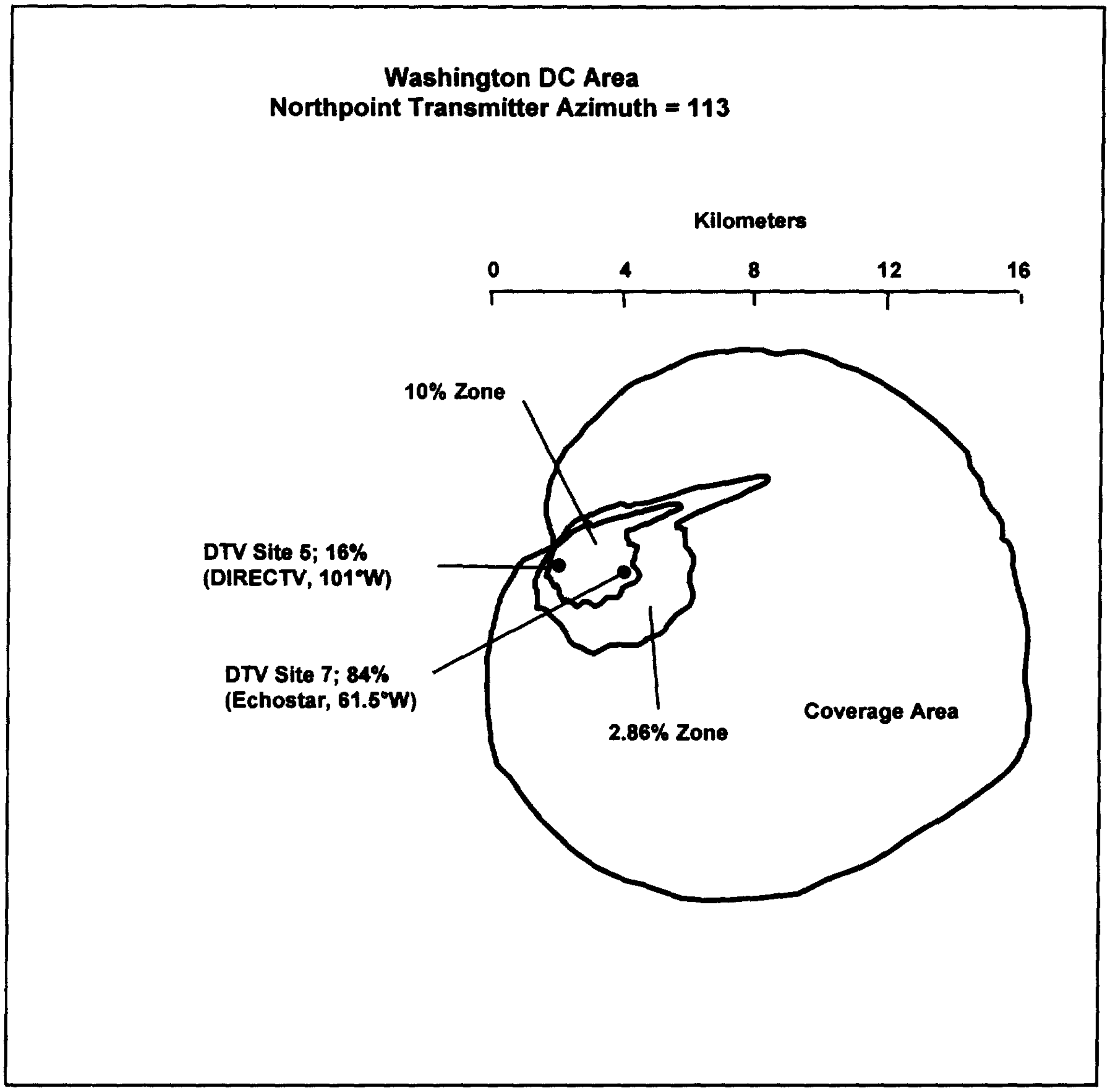

Figure 6.2.3-3:
Interference Zones, Southeasterly Directed Terrestrial Transmission, Washington, D.C. Area

Included in Figure 6.2.3-3 are two points indicating the locations of two significant DIRECTV test sites for the Washington, D.C. demonstration. These are DIRECTV site 5 ("Iwo Jima Memorial B"), and DIRECTV site 7 (Ericsson Memorial/Polo Field). Both of these sites are located within the 10% unavailability degradation contour. DIRECTV observed an interference level at Site 5 sufficient to produce a 15% degradation in unavailability performance for service from 101° W.L. DIRECTV observed an interference level at Site 7 sufficient to produce an 84% degradation in unavailability performance. These findings support the existence of the interference zones depicted in Figure 6.2.3-3.

7 *Conclusion*

In response to the Northpoint proposal to introduce its terrestrial technology into the DBS downlink band, DIRECTV has expended enormous effort, including:

- conducting careful and extensive analysis of all of the Northpoint filings submitted to the Commission to date;
- taking detailed field measurements of Northpoint's D.C. tests;
- conducting its own tests to establish the fact and types of Northpoint harmful interference that will be generated;
- collaborating with respected terrestrial engineers to model and assess the "real-world" impact of Northpoint technology on DBS subscribers' receipt of service;
- adapting and applying appropriate protection criteria based upon years of rigorous technical work with the international community; and
- with Echostar, applying for its own authorization to further establish the harmful interference the Northpoint technology will cause to DBS operations in a credible, scientific manner.

As DIRECTV has taken these steps, it has become apparent that Northpoint's proposed operations unquestionably will cause harmful, unacceptable interference to DBS operations and subscribers' receipt of DBS service. Northpoint's experimental results to date have not shown the feasibility of reasonable co-existence on a secondary basis with primary DBS operations. In fact, they have shown just the opposite. Unless the prospect of such co-existence can be verified through rigorous testing, and the Northpoint technology can be shown to operate in compliance with appropriate interference protection criteria, it is not in the public interest for the Commission to take further steps to facilitate deployment of the service at 12 GHz.

APPENDIX A

In this appendix, unavailability calculations for DIRECTV service to Washington, D.C. are described.

Representative DIRECTV Link Budget for Washington, D.C.

Table 1 presents a representative link budget for DIRECTV's service in the Washington, D.C. area. The calculation formulas used in this link budget are identical to those used in the link budgets DIRECTV submitted to the Special Rapporteur Group 2 of JWP 10-11S for use in NGSO interference analyses, and also those presented in DIRECTV's earlier filings in this docket.[29] For the new interference term for Northpoint shown in line 12, the calculations are performed by not fading the interference with rain, which is a reasonable assumption for receiving sites close to the Northpoint transmitter. The entry in line 14 is the minimum C/N+I value (that is, the carrier-to-noise-plus-interference ratio, expressed in decibels) for which the DBS receiver provides quasi-error-free operation when tuned to an even numbered transponder. This was chosen because DIRECTV's transponder 18 had the largest frequency overlap with the transmission spectrum used by Northpoint during their Washington, D.C. tests. Line 43 shows the total clear-sky margin available in the link (7.2 dB). Line 5 contains the link availability calculated using the rain model described in ITU-R Recommendation P.618-5 (an excellent 99.9399%). Note that in line 12, the C/I value for interference from Northpoint is 99 dB, meaning that no such interference is present.

[29] *See* Comments of DIRECTV, Inc., ET Docket No. 98-206 (Mar. 2, 1999).

			No Northpoint Interference
1			
2		Units	Washington, DC
3	System Characteristics		
4	Frequency	GHz	12.7
5	Availability	%	99.9399
6	Outage Hours		5.26
7	Increase in outage hours		—
8	Percentage increase in unavailability		—
9	Receiver noise bandwidth	MHz	24
10	Modulation type		QPSK
11	C/I due to other GSO BSS networks	dB	20.7
12	Clear sky C/I due to NorthPoint corresponding to percentage increase in unavailability	dB	99
13	Clear sky feeder link C/N+I	dB	24.2
14	C/N+I required at operating threshold	dB	5.0
15	Clear sky C/N+I margin above operating threshold	dB	7.5
16	Space station characteristics		
17	Longitude	°	101W
18	Satellite e.i.r.p. in the direction of the earth station	dBW	52.2
19	Earth station characteristics		
20	Receive antenna diameter	cm	45
21	Receive antenna efficiency	%	70
22	On-axis antenna gain at receiver input	dBi	34
23	Off-axis antenna gain characteristics		App 30, An. 5
24	Clear sky receive system noise temperature at receiver input	K	125
25	Clear sky G/T	dB/K	13
26	Total pointing loss	dB	0.5
27	Latitude	°N	38.5
28	Longitude	°E	-77.0
29	Rain climatic zone		K
30	Elevation angle	°	38.5
31	Propagation characteristics		
32	Slant path	km	37882
33	Free space loss	dB	206.1
34	Atmospheric absorption	dB	0.2
35	Rain attenuation for availability percentage of time	dB	4.2
36	Noise increase due to rain for availability percentage of time	dB	3.9
37	Downlink budget clear sky		
38	C/N thermal clear sky downlink	dB	13.2
39	C/N+I clear sky downlink	dB	12.5
40	C/N+I clear sky total link	dB	12.2
41	Clear sky C/N downlink margin above operating threshold	dB	8.2
42	Clear sky C/N+I downlink margin above operating threshold	dB	7.5
43	Clear sky C/N+I total margin above operating threshold	dB	7.2
44	Downlink budget for availability percentage of time		
45	C/N thermal for availability percentage of time, downlink	dB	5.1
46	C/N+I for availability percentage of time, downlink	dB	5.0
47	C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1
48	C/N+I margin above operating threshold for availability percentage of the time, downlink	dB	0.0

Table 1: Representative link budget for DIRECTV service to Washington, D.C.

Increase in DBS link unavailability versus Interference Power

This link budget can be used to calculate the percentage increase in unavailability (line 8) that could be caused by a constant, noise-like interference source. The two rightmost columns in Table 2 show the C/I, or the carrier-to-interference ratio expressed in decibels, that would produce a 10% and a 2.86% increase in link unavailability, respectively.

1			No Northpoint Interference	With Northpoint Interference	With Northpoint Interference
2		Units	Washington, DC	Washington, DC	Washington, DC
3	System Characteristics				
4	Frequency	GHz	12.7	12.7	12.7
5	Availability	%	99.9399	99.9339	99.9382
6	Outage Hours		5.26	5.79	5.41
7	Increase in outage hours		----	0.53	0.15
8	Percentage increase in unavailability		----	10.00%	2.86%
9	Receiver noise bandwidth	MHz	24	24	24
10	Modulation type		QPSK	QPSK	QPSK
11	C/I due to other GSO BSS networks	dB	20.7	20.7	20.7
12	Clear sky C/I due to NorthPoint corresponding to percentage increase in unavailability	dB	99	21.9	27.2
13	Clear sky feeder link C/N+I	dB	24.2	24.2	24.2
14	C/N+I required at operating threshold	dB	5.0	5.0	5.0
15	Clear sky C/N+I margin above operating threshold	dB	7.5	7.0	7.4
16	Space station characteristics				
17	Longitude	°	101W	101W	101W
18	Satellite e.i.r.p. in the direction of the earth station	dBW	52.2	52.2	52.2
19	Earth station characteristics				
20	Receive antenna diameter	cm	45	45	45
21	Receive antenna efficiency	%	70	70	70
22	On-axis antenna gain at receiver input	dBi	34	34	34
23	Off-axis antenna gain characteristics		App 30, An. 5	App 30, An. 5	App 30, An. 5
24	Clear sky receive system noise temperature at receiver input	K	125	125	125
25	Clear sky G/T	dB/K	13	13	13
26	Total pointing loss	dB	0.5	0.5	0.5
27	Latitude	°N	38.5	38.5	38.5
28	Longitude	°E	-77.0	-77.0	-77.0
29	Rain climatic zone		K	K	K
30	Elevation angle	°	38.5	38.5	38.5
31	Propagation characteristics				
32	Slant path	km	37882	37882	37882
33	Free space loss	dB	206.1	206.1	206.1
34	Atmospheric absorption	dB	0.2	0.2	0.2
35	Rain attenuation for availability percentage of time	dB	4.2	4.1	4.2
36	Noise increase due to rain for availability percentage of time	dB	3.9	3.8	3.9
37	Downlink budget clear sky				
38	C/N thermal clear sky downlink	dB	13.2	13.2	13.2
39	C/N+I clear sky downlink	dB	12.5	12.0	12.4
40	C/N+I clear sky total link	dB	12.2	11.8	12.1
41	Clear sky C/N downlink margin above operating threshold	dB	8.2	8.2	8.2
42	Clear sky C/N+I downlink margin above operating threshold	dB	7.5	7.0	7.4
43	Clear sky C/N+I total margin above operating threshold	dB	7.2	6.8	7.1
44	Downlink budget for availability percentage of time				
45	C/N thermal for availability percentage of time, downlink	dB	5.1	5.4	5.2
46	C/N+I for availability percentage of time, downlink	dB	5.0	5.0	5.0
47	C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.4	0.2
48	C/N+I margin above operating threshold for availability percentage of the time, downlink	dB	0.0	0.0	0.0

Table 2: C/I ratio that produces 10% and 2.86% increase in link unavailability

This procedure can be used to calculate the increase in unavailability for other values of C/I. Figure 1 shows a plot of percentage increase in unavailability versus C/I ratio.

Increase in Unavailability vs. Interference Level

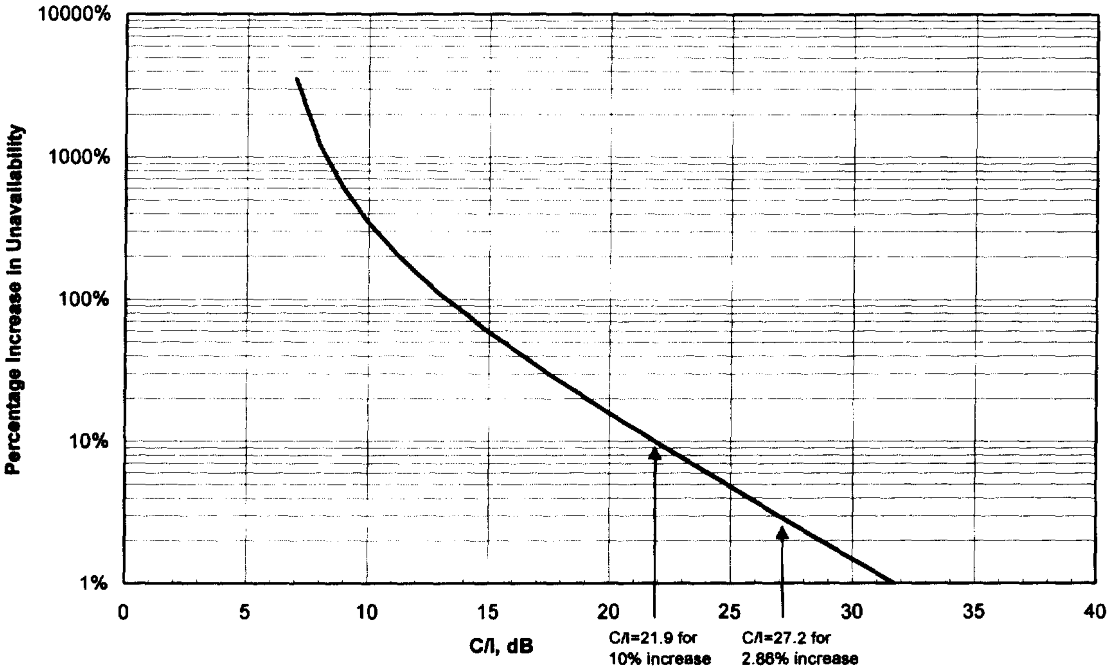

Figure 1: Increase in unavailability for Washington, D.C. as a function of C/I ratio

Interference power that produces specific C/I ratios

This information can now be used to calculate the interference power that produces a specific C/I ratio, that in turn produces a specific increase in unavailability. Line 13 in Table 3 shows the value of interference power that produces C/I ratios of 21.9 and 27.2 dB at the input to the DBS receiver. The calculation in the table does not include the gain of the earth station antenna toward the terrestrial transmitter; that factor is introduced in the service area calculations.

1	DIRECTV Service to Washington, DC (Transponder 18)	Units	No Northpoint Interference	10% Increase in Unavailability	2.86% Increase in Unavailability
2	Frequency	GHz	12.7	12.7	12.7
3	Percentage increase in unavailability		—	10.00%	2.86%
4	C/I clear sky	dB	99	21.9	27.2
5	Satellite e.i.r.p. in the direction of the earth station	dBW	52.2	52.2	52.2
6	On-axis antenna gain at receiver input	dBi	34	34	34
7	Slant path	km	37882	37882	37882
8	1/R^2 loss	dB(1/m2)	-163	-163	-163
9	Atmospheric absorption	dB	-0.2	-0.2	-0.2
10	Pointing Loss	dB	-0.5	-0.5	-0.5
11	Carrier pfd	dB(W/m2)	-111.1	-111.1	-111.1
12	Carrier Power at antenna output (includes no LNB gain)	dBW	-120.6	-120.6	-120.6
13	Northpoint RSSi	dBW	—	-142.5	-147.8

Table 3: Calculation of interference power that produces C/I = 21.9 and 27.2 dB

The entries in line 13 of Table 3 are the RSSi (received isotropic signal strength) values for interference levels that would produce 10% and 2.86% unavailability degradation in our service. The RSSi value that defines Northpoint's edge of coverage is -156 dBW, which provides 2 dB for fade margin and 1.5 dB for rain margin.[30]

These calculations can also be performed for Seattle, as was done in the March 2, 1999 Comments filed by DIRECTV. The major factor to be considered is that Seattle has a much lower satellite effective isotropic radiated power (48 dBW) as compared to Washington, D.C. (52.2 dBW). When this adjustment is made, the RSSi values become -146.8 dBW and -152.1 dBW for 10% and 2.86% availability degradation, respectively.

[30] *See* Table 2.1-1 and accompanying text in Technical Appendix B to the Comments of DIRECTV, INC., ET Docket No. 98-206 (Mar. 2, 1999).

CERTIFICATE OF SERVICE

I, James H. Barker, hereby certify that on this 27th day of January, 2000 that copies of the foregoing Conclusions to Date Regarding Harmful Interference From a Proposed Northpoint Technology Terrestrial System Operating in the DBS Downlink Band, 12.2-12.7 GHz were delivered by prepaid, first class U.S. mail or hand delivery (*) to the following:

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